2016 Lower Michigan Fire Weather Area Operating Plan

Introduction

This Fire Weather Annual Operating Plan (FWAOP) was developed to enhance the communication and organization between members of The National Weather Service along with federal and state user agencies, for the 2016 fire season. This AOP was written from information compiled in The National Weather Service Directive 10-4, and the 2015 FWAOP.

Appendices

- Internet Spot Forecast request procedures (Appendix A)
- Example of products issued (Appendix B)
- Fire Weather Indices (Appendix C)
- Lower Michigan Fire Weather Zone Groupings (Appendix D)
- Experimental Smoke Modeling Plumes (Appendix E)

Service Area and Organization

Service Areas

The National Weather Service Office in Gaylord will prepare Fire Weather Forecasts, Point (NFDRS) Forecasts, Spot forecasts, and Red Flag event support for the following fire control/land management agencies in Lower Michigan:

- Huron-Manistee National Forest in Northern Lower Michigan along and north of M-55
- Sleeping Bear Dunes National Lakeshore in Northern Lower Michigan
- State forest lands along and north of M-55 in Northern Lower Michigan

National Weather Service Office in Grand Rapids will prepare Fire Planning Weather Forecasts, Point (NFDRS) Forecasts, Spot forecasts, and Red Flag event support for the following fire control/land management agencies in Lower Michigan:

- Manistee National Forest in West-Central Lower Michigan south of M-55
- State forest lands south of M-55 in Southwest Lower Michigan

National Weather Service Office in White Lake Township, MI will provide Fire Weather Planning Forecasts, Red Flag event support and Spot Fire Weather Forecasts in Lower Michigan for the following fire control/land management agencies:

- Shiawassee National Wildlife Refuge in Lower Michigan
- State and local land management agencies across Southeast Michigan

National Weather Service Office in Northern Indiana will provide Fire Weather Planning Forecasts and Spot Fire Weather Forecasts for the following fire control/land management agency in Michigan:

- State and local land management agencies in Berrien, Cass, St. Joseph, Branch and Hillsdale counties

Backup

In events in which the National Weather Office Gaylord cannot provide routine services, as laid out in this FWAOP, then the National Weather Service Office Marquette will assume responsibility for fire weather products and services needed over Northern Lower Michigan. In the event the National Weather Service Office Marquette cannot provide routine services as laid out in their FWAOP, then the National Weather Service Office Gaylord will assume responsibility for all fire weather products and services needed over Upper Michigan.

The National Weather Service Office in Marquette prepares the fire weather products for the following fire control/land management agencies in Upper Michigan.

- Ottawa National Forest in Upper Michigan
- Hiawatha National Forest in Upper Michigan
- Isle Royale National Park in Lake Superior
- Pictured Rocks National Lakeshore in Upper Michigan
- Seney Wildlife Refuge in Upper Michigan

Similarly, the National Weather Service in White Lake will be the back up for the Grand Rapids office for routine fire weather services. In turn, Grand Rapids will back up the White Lake office for routine fire weather services.

The National Weather Service in Indianapolis will serve as back up for the National Weather Service in Northern Indiana.

National Weather Service contacts

WFO Detroit/Pontiac:
Administration: (248)625-3309
FAX: (248)625-4834

Contacts:

Fire Weather Program Leader:	Heather Orow	heather.orow@noaa.gov
Meteorologist In Charge:	Dick Wagenmaker	richard.wagenmaker@noaa.gov
Warn. Coordination Meteorologist:	Rich Pollman	richard.pollman@noaa.gov
Science Operations Officer	Greg Mann	greg.mann@noaa.gov

Mailing Address: NWS office, NOAA
Fire Weather Program
9200 White Lake Rd
White Lake Township, MI 48386

WFO Gaylord:

Administration: (989)731-3384
FAX: (989)731-0682
Contacts:

Fire Weather Program Leader:	Jeff Lutz	Jeffrey.lutz@noaa.gov
Meteorologist in Charge:	Bruce Smith	bruce.smith@noaa.gov
Warn. Coordination Meteorologist:	Jim Keysor	james.keysor@noaa.gov
Science Operations Officer:	John Boris	John.boris@noaa.gov

Mailing Address: **NWS Office, NOAA**
Fire Weather Program
8800 Passenheim Road
Gaylord, MI 49735-9454

WFO Grand Rapids:
Administration: (616) 949-0643
FAX: (616) 949-1708
Contacts:

Fire Weather Program Leader:	Nathan Jeruzal	nathan.jeruzal@noaa.gov
Meteorologist in Charge:	Daniel Cobb	daniel.cobb@noaa.gov
Warn. Coordination Meteorologist:	Jim Maczko	james.maczko@noaa.gov
Science and Operations Officer:	TJ Turnage	thomas.turnage@noaa.gov

Mailing Address: **NWS Office, NOAA**
Fire Weather Program
4899 South Complex Dr. SE
Grand Rapids, MI 49512-4034

WFO Northern Indiana:
Administration: (574)834-1104
FAX: (574)834-3492
Contacts:

Fire Weather Program Leader:	Lonnie Fisher	lonnie.fisher@noaa.gov
Meteorologist in Charge:	Mark Frazier	mark.frazier@noaa.gov
Warn. Coordination Meteorologist:	Michael Lewis	michael.lewis@noaa.gov
Science Operations Officer:	Jeffrey Logsdon	jeffrey.logsdon@noaa.gov

Mailing Address: **NWS Office, NOAA**
Fire Weather Program
7506 East 850 North
Syracuse, IN 46567

WFO Marquette:

Administration: (906)475-5782
FAX: (906)475-6305

Contacts:

Fire Weather Program Leader:	Kari Fleegel	kari.fleegel@noaa.gov
Asst. Fire Weather Program Leader:	Jason Alumbaugh	jason.alumbaugh@noaa.gov
Meteorologist in Charge:	Robin J Turner	robin.j.turner@noaa.gov
Warn. Coordination Meteorologist:	Matt Zika	matthew.zika@noaa.gov
Science Operations Officer:	Vacant	

Mailing Address: NWS Office, NOAA
Fire Weather Program
112 Airpark Drive South
Negaunee, MI 49866-9526

Land Management Agency Contacts in Lower Michigan

Eastern Area Coordination Center (EACC)

Main Office - Milwaukee
Main Phone: (414)944-3811
Office Fax: (414)944-3838

Mailing Address:
626 E. Wisconsin Ave.
Suite 500
Milwaukee, WI 53202

EACC Fire Weather Program Manager – Stephen Marien Stephen_Marien@nps.gov
Main Phone: (651)293-8446
Office Fax: (651)290-3815

Mailing Address:
111 East Kellogg Blvd. Suite 105
St. Paul, MN 55101

U.S. Forest Service

Huron-Manistee National Forest
Dispatch (Day): (231)775-5023 X8775 mihmfc@fs.fed.us

Supervisor's Office (Cadillac)

Chris A. Peterson – Forest FMO	(231)775-5023 X8724	capeterson@fs.fed.us
Steve Nurse	(231)775-5023 X8752	snurse@fs.fed.us
Debra-Ann Brabazon – Center Manager	(231)775-5023 X8750	dbrabazon@fs.fed.us
Jae Naugle – Assistant Center Manager	(231)775-5023 X8794	jnaugle@fs.fed.us

Dispatchers (231)775-5023
Bruce Amsbary
Rob Chapman
Kim Owczarzak

Fax: (231)775-8742

Mailing Address:
1755 South Mitchell St.
Cadillac, MI 49601

West Zone (Baldwin)
Steve Hatting – W. Zone FMO (231)745-4631 shatting@fs.fed.us
Fax: (231)745-2345

East Zone (Huron Shores)
Joseph Alyea – E. Zone FMO (989)739-0728 X3101 jalyea@fs.fed.us
X3356
Fax: (989)739-0951

National Park Service

Sleeping Bear Dunes National Lakeshore
Kevin Skerl– Chief of Natural Resources (231)326-4750 kevin_skerl@nps.gov
Tom Davison – Park Dispatcher (231)326-4742 tom_davison@nps.gov
Dispatch (231)326-4742
Fax (231)326-5653

Mailing Address:
9922 Front Street Hwy M-72
Empire, MI 49630

Indiana Dunes National Lakeshore
Dan Morford – FMO (219)395-8840 dan_morford@nps.gov
Mary Whitenack – AFMO (219)395-1683 mary_ellen_whitenack@nps.gov

U.S. Fish and Wildlife, Michigan

U.S. Fish and Wildlife Refuges, (Michigan)

Gary Lindsay – FMO, MI Satellite (906)586-9851 X19 gary_lindsay@fws.gov
FAX (906)586-3800

Mailing Address:
Seney National Wildlife Refuge
1674 Refuge Entrance Road
Seney, MN 49883

U.S. Fish Wildlife North Zone (Michigan & Wisconsin)

Dan Laber – WI & MI Zone FMO (608)565-4407 daniel_laber@fws.gov

Kirtland Wildlife Management Area, Seney National Wildlife Refuge & Michigan Islands

Greg McClellan – Dep. Refuge Manager (906)586-9851 X13 greg_mcclellan@fws.gov
Sara Siekierski - Refuge Manager (906)586-9851 X11 sara_siekierski@fws.gov

Detroit River International Wildlife Refuge

Steve Dushane – Dep. Refuge Manager (734) 692-7608 steve_dushane@fws.gov
John Hartig - Refuge Manager (734) 692-7608 john_hartig@fws.gov

Shiawassee National Wildlife Refuge & Michigan Islands

Eric Dunton - Biologist (989)777-5930 X14 eric_dunton@fws.gov
Steve Kahl – Refuge Manager (989)777-5930 X16 steve_kahl@fws.gov

Michigan Private Lands Office & Michigan Wetland Management District

Jim Hazelman – Asst. State Coordinator (517)351-6235 jim_hazelman@fws.gov
Jim Hudgins - State Coordinator (517)351-6235 jim_hudgins@fws.gov

Bureau of Indian Affairs

Will Wiggins (906)353-7289 (office) wwiggins@up.net
(906)353-7299 (fax)

Mailing Address:
100 Hemlock Street
Baraga, MI 49908

Michigan Dept of Natural Resources

Roscommon - Phone (989)275-5151 or (989)275-5019

Roscommon - FAX	(989)275-5167	
Fire Duty officers and extensions:		
Don Klingler	(989)275-5151 Ext. 2040	klinglerd@michigan.gov
Lee Osterland	(989)275-5151 Ext. 2042	osterlandl@michigan.gov
Rita Defibaugh	(989) 275-5151 Ext. 2920	defibaughr@michigan.gov

Mailing Address:
8717 North Roscommon Rd.
Roscommon, MI 48653

Land Management Agency Contacts in Upper Michigan

U.S. Forest Service

Ottawa National Forest:

IC Dispatch	(906)358-0531 ext. 19	
FMO (Vacant)		
Dispatcher – Brian Sabin	(906)358-4067	bsabin@fs.fed.us
Fax:	(906)358-4069	

Mailing Address:
E 32979 US Hwy 2 East
Watersmeet, MI 49969

Hiawatha National Forest:

Main Office	(906)428-5800	
Dispatcher – Vacant	(906)428-5891	
FMO– Steve Nurse	(906)428-5822	snurse@fs.fed.us
Fax	(906)428-9030	

Mailing Address:
820 Rains Drive
Gladstone, MI 49837

National Park Service

Pictured Rocks National Lakeshore

Dispatch	(906)428-5891	
Matt Davis – Chief Ranger	(906)387-2607 X 203	matthew_davis@nps.gov

Mailing Address:
N8391 Sand Point Road
P.O. Box 40
Munising, MI 49862

Isle Royale National Park

Richard Moore – Chief Ranger	(906)487-7148	Richard_Moore@nps.gov
Marshall Plumer - East District Ranger	(906)487-7174	Marshall_Plumer@nps.gov

Mailing Address:
800 East Lakeshore Drive
Houghton, MI 49931

U.S. Fish and Wildlife, Michigan

Seney National Wildlife Refuge & Other Refuges in The UP

Greg McClellan - Deputy Refuge Manager	(906)586-9851 X13	greg_mcclellan@fws.gov
Sara Siekierski - Refuge Manager	(906)586-9851 X11	sara_siekierski@fws.gov

Michigan Dept of Natural Resources

Marquette Dispatch

Marquette – Phone	(906)249-1497	
Acting Duty Officer	(906)249-9222	
Celeste Chingwa – Protection Officer	(906)249-2466	chingwac@michigan.gov
Bruce Avery – Fire Specialist	(906)249-3502	averyb1@michigan.gov
Keith Murphy – Fire Specialist		murphyk1@michigan.gov

Mailing Address:
110 Ford Rd.
Marquette, MI 49855

Routine Services provided by the National Weather Service

Format of Fire Planning Weather Forecasts and times of issuance are coordinated with the

customers at the beginning of each season. The format of the fire weather products will comply with standards set forth in NWS Instruction 10-401. The format is standardized, in an effort to better serve transient fire fighters. The fire fighters can look at any National Weather Service Fire Weather Forecasts, and be familiar with the format so that critical weather information can be easily obtained.

The National Fire Danger Rating System (Point) forecasts will be issued to determine fire danger on an as needed basis. These are initiated by the reception of 1300 (local time) observation at the designated points.

Special forecasts, such as Spot Forecasts, will be issued as needed for on-going fires, prescribed burns, spraying or other special projects of the fire protection agencies.

A red flag program will be maintained throughout the fire season, to support fire agencies in wildfire prevention and suppression tactics.

Close liaison between the National Weather Service and the fire control agencies will be maintained to insure a smooth exchange of essential information.

Below are the fire weather products issued by Weather Forecast Office Gaylord:

- ARBFWFAPX- Routine Fire Weather Forecast
- ARBFWMAPX- NFDRS (point) forecasts (Mio, Bear, Wellston, and Silver Creek)
- ARBFWSAPX- Spot Forecasts
- ARBRFWAPX- Fire Weather Watch or Red Flag Warning

Below are the fire weather products issued by Weather Forecast Office Grand Rapids:

- ARBFWFGRR- Routine Fire Weather Forecast
- ARBFWMGRR- NFDRS (point) forecasts (Baldwin)
- ARBFWSGRR- Spot Forecasts
- ARBRFWGRR- Fire Weather Watch or Red Flag Warning

Below are the fire weather products issued by Weather Forecast Office White Lake:

- ARBFWFDTX- Routine Fire Weather Forecast
- ARBFWSDTX- Spot Forecasts
- ARBRFWDTX- Fire Weather Watch or Red Flag Warning

Below are the fire weather products issued by Weather Forecast Office Northern Indiana:

- INDFWFIWX- Routine Fire Weather Forecast
- INDFWSIWX- Spot Forecasts
- INDRFWIWX- Fire Weather Watch or Red Flag Warning

More specific information on the above products is provided below.

Routine Fire Weather Forecast

This forecast has two scheduled issuances, between 400 am and 700 am in the morning, and between 300 pm and 400 pm in the afternoon. The morning forecast will contain three periods and an extended forecast, while the afternoon forecast will contain four periods and an extended forecast. A standard fire zone grouping has been established to better facilitate information for areas that may experience similar conditions. Adjustment of these groupings can be performed on an as needed basis to address representative fuel conditions in a particular area after coordination with affected state and federal officials. These groupings will be reviewed at least annually. A graphic of the current zone grouping can be found in Appendix D.

The forecasts will contain the following elements:

- **Headline** - The headline should capture the most important aspect of the forecast, or a trend. If a Red Flag Warning or Fire Weather Watch is in effect, then this becomes the headline.
- **Discussion** – This is a short paragraph outlining the synoptic features affecting the Great Lakes region during the next 24 to 36 hours. An outlook also may be produced to highlight potential dangerous fire weather conditions expected in the next few days.
- **Other forecast elements** will include: cloud cover, chance and type of precipitation, precipitation amount, max and min temperatures and its trend, max and min relative humidity and its trend, 20-foot winds in MPH, mixing height in 1000's of feet, and transport winds in knots.
- **Haines Index** - This is a stability index with reportable values that range from 2 to 6. You can calculate the Haines Index by using model soundings.
- **Ventilation Index (VI)** - A smoke management tool used to measure the stability of the atmosphere, in order to indicate how effectively it will disperse fire generated pollutants.
- The extended forecast will be appended to the end of the tabular part of the product and will include the winds through day 7.

This forecast will be updated whenever the following conditions are warranted.

- A Fire Weather Watch is issued, cancelled or expired
- A Red Flag Warning is issued, cancelled or expired
- Current trends do not support the valid forecast

Methods of receiving and accessing routine Fire Planning Weather Forecasts, is as follows:

- Agencies can routinely access the forecast via the internet at weather.gov/gaylord,

weather.gov/grandrapids, weather.gov/detroit, weather.gov/northernindiana or through WIMS (Weather Information and Management System).

- If the above options are not available, then agencies are encouraged to call the respective National Weather Service Office directly.

NFDRS (point) Forecast

The Point Forecast is issued for a specific point within the fire weather area of responsibility (see stations below) and is valid for a twenty-four (24) hour period (through 100 pm the following day). For example, if the NPS wants a Point Forecast for Wednesday at "The Bear", they will send the 100 pm weather conditions from the site on Tuesday to serve as a reference for the forecast. The Point Forecast for The Bear, would be valid through 100 pm the next day (in this case it would be a Point Forecast for Wednesday at 100 pm at BEAR).

Point forecast Stations:

Station	ID #	COUNTY	AGENCY	LAT	LON
Office: **GRR**					
Baldwin	203802	Lake	USFS	43.9	85.8
Office: **APX**					
Mio	202902	Oscoda	USFS	44.4	84.1
Bear	202010	Leelanau	NPS	44.5	86.0
Wellston	203101	Manistee	USFS	44.2	85.9
Silver Creek	203601	Iosco	USFS	44.4	83.6

The format for NFDRS forecast is found in NWS Instruction 10-401.

Spot Forecasts

This forecast is prepared for a single location for a very distinct period of time, usually 6 to 12 hours. The forecast is usually requested by federal and state agencies during wildfires or prescribed burns.

The forecast elements will usually consist of the highest or lowest temperature during the period, the highest or lowest relative humidity, wind direction and speed, chances of precipitation and duration.

Spot Forecast requests can come into the office by several means, the internet, by fax, or by phone. The preferred method for requesting or receiving Spot Forecasts will be via the internet. If internet usage is not possible for requesting or receiving Spot Forecasts, then requesting agencies should call the respective NWS office to request the forecast. Instructions for submitting a Spot Forecast request by user agencies, and instructions for completing the Spot Forecast by National Weather Service employees via the internet, are found in Appendix B.

When a request for a Spot Forecast is made by phone, National Weather Service employees should use the Spot Forecast form to help prepare the forecast. Upon receiving a call for a Spot Forecast, the NWS forecaster should ask for the location lat/lon, current observation including temperatures, relative humidity, wind direction and speed location. Elevation, aspect, fuel type,

and requesting official and contact phone number should also be given for the site before beginning the forecast process.

Whether the Spot Forecast request is made by phone or the internet, NWS employees will complete the request utilizing the internet process (Appendix B). When the forecast is submitted it will produce a product in AWIPS, which is printed automatically and stored locally. This form can be used for faxing.

Experimental Model Smoke Plumes

Land management agencies that have a wildfire of 100 acres or greater, or are conducting a prescribed burn of 100 acres or greater, may request that the local National Weather Service Office run the NOAA Air Resources Laboratory dispersion model, HYSPLIT, to model smoke dispersion. This model is a combination of the U.S. Forest Service's Blue Sky Model and meteorological models used by NWS Forecasters. This data is output in a graphical form and is considered experimental since it is relatively new, and only limited testing has been conducted thus far. This data can be used in addition to a typical spot forecast that is used for Prescribed Burns and Wildfires. More information on the procedures for requesting this and how to interpret the data can be found in Appendix E at the end of this AOP.

Weekly Fire Weather Briefings

During the months of April and May, a weekly weather briefing will conducted by a NWS Meteorologist from one of the four NWS offices that service the land management agencies in Lower Michigan. Additional briefings may be requested by the land management agencies outside of this time period. The purpose of these briefings will be to provide an outlook of weather to assist the agencies in the planning of resources out through seven days during the active portion of the fire season. The day and time of these briefings will be determined by coordination between the NWS offices and all of the land management agencies. The webinars should include the use of the web based "Join.Me" software, and a conference call. The briefing will be then emailed out to the contacts on the webinar list.

In addition to the weekly briefing listed above, a briefing concerning an expected Red Flag event will be conducted by the NWS offices when requested by the land management agencies. This request will likely come during the weekly fire weather briefing. Please see more details on the Red Flag webinar under the Watch/Warning Events section.

Watch/Warning Events

Fire Weather Watches and Red Flag Warnings

A Fire Weather Watch or Red Flag Warning is issued whenever extremely dry fuels are forecast

to combine with critical weather parameters to create an atmosphere that could contribute to extensive wildfires with the potential to threaten life and property. Any watch or warning should be coordinated with the affected land management agency for the zone(s) where the watch or warning is being considered or has been issued.

A Red Flag warning may also be requested by a land management agency, if they feel that due to extreme dryness in the forest, that wildfires are likely. Otherwise, if conditions are expected to be close to or exceed red flag conditions, then an appropriate statement should be put into the Hazardous Weather Outlook (ARBHWOxxx and INDHWOIWX for far Southern Lower Michigan counties covered by Northern Indiana).

Fire Weather Watch Criteria

Whenever a geographical area has been dry for a week or two (or for a shorter period if before spring green-up or after fall color), the National Fire Danger Rating System (NFDRS) is high to extreme and critical weather conditions are expected then a Fire Weather Watch should be considered. Before issuing a Fire Weather Watch, coordinate you concerns with the pertinent land management agencies. Consider a watch, whenever the above conditions will combine with these forecast weather parameters within the next 24 to 48 hours are:

1. Sustained wind averaging >= 15 mph (20 ft RAWS winds) or >=20 mph (10m ASOS winds)
2. Relative humidity <= 25 percent
3. Temperature >= 75 degrees.

(Frequent wind gusts reaching the above wind criteria may be used in place of sustained winds at WFO's APX and GRR. This is to increase flexibility and provide additional support when needed to National Forest lands; and to account for differences in land use and fuel types that may be more sensitive to potential wildfire spread across portions of Northern and Western Lower Michigan.)

Red Flag Warning Criteria

A Red Flag Warning will be issued when the Fire Weather Forecaster has a high degree of confidence that all three critical weather conditions, listed below, will occur within 24 hours.

1. Sustained wind averaging >= 15 mph (20 ft RAWS winds) or >=20 mph (10m ASOS winds)
2. Relative humidity <= 25 percent and
3. Temperature >= 75 degrees.

(Frequent wind gusts reaching the above wind criteria may be used in place of sustained winds at WFO's APX and GRR. This is to increase flexibility and provide additional support when needed to National Forest lands; and to account for differences in land use and fuel types that may be more sensitive to potential wildfire spread across portions of Northern and Western Lower Michigan.)

The fire weather watch or red flag warning can be issued on a county by county basis. The land management agencies and the NWS offices will discuss the area that will be contained within the urgent fire weather message.

Issuing a Red Flag Warning or Fire Weather Watch

Call the affected land management agency for the zone where the watch or warning was issued to inform them of the warning and to coordinate what information is to be included in any public statement.

1. Issue the Red Flag Warning as ARBRFWxxx or INDRFWIWX (Northern Indiana).
2. The warning will include the geographic area, duration of the event and key weather parameters.
3. Headline in the daily Fire Weather Forecast (ARBFWFxxx or INDFWFIWX).
4. Subsequent Red Flag Warning messages or routine weather forecasts will carry the warning or watch headline until it is canceled.

Fire Weather Watch/Red Flag Warning Cancellation/Expiration

1. Call Land Management officials.
2. Issue the ARBRFWxxx or INDRFWIWX to cancel the watch or warning.
3. Headline the cancellation in the daily Fire Weather Forecast.

Marginal Events

When conditions are expected to approach Red Flag Warning conditions, a coordination call should take place between the NWS and the various land management agencies. This coordination call will determine whether a Red Flag Warning is required, or whether notification to raise the awareness of the elevated fire danger is desired. The notification includes web stories on NWS web pages, message notification to Emergency Managers and media, mention in the Hazardous Weather Outlook, and Social Media.

Verification

Fire Weather Watches and Red Flag Warnings will be verified based on synoptic events. Verification of Red Flag events will be tracked for all fire weather zones. The criteria are as stated previously.

Webinars

Webinars will be provided to the land management agencies as requested prior to a Red Flag event. The webinars will be conducted similar to the weekly webinars as listed above. The content will include important, yet simple information to help the land management agencies make decisions pertaining to the potential Red Flag event.

Non-routine services

The National Weather Service will assist any Federal or State agency in training purposes. Typically, the National Weather Service has served as instructors for the weather portions of

the S-290 and S-190 hosted by the USFS or DNR. On different occasions, the National Weather Service has also agreed to supply training/instruction support for state and federal agencies in more general purposes, such as seasonal outlooks during late winter staff meetings or regional gatherings. This type of service will continue in the future.

Wildland Fire Agency Responsibilities

The agency responsibility will be as noted in the Interagency Agreement for Meteorological Services, between federal and state user agencies and the National Weather Service. This has been appended.

Effective Date of the AOP

The beginning and ending dates of the fire weather season are determined by federal and state agencies in coordination with the National Weather Service Fire Weather Program Leader at the respective weather forecast office. These dates are a function of the first or last snow and by the state of vegetation. Typically the fire weather season for Lower Michigan extends from mid-March through mid-November.

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Appendix A -Spot Forecast instructions

Instructions for Submitting a Spot Forecast request via the internet - user agency:

- From the respective NWS Homepage click on Fire Weather under Forecasts.
- Click on the county where the fire or burn is or will take place.
- Click on submit a new spot request
- Enter data into the request form (red means a mandatory entry)
- If automated experimental HYSPLIT images are requested, type in Hysplit and email address(es) into the remarks section
- Click submit request at the bottom of the form. When the status reads complete (color in red on the map), then click on your request, to see the forecast.
- Check the status of your request from the Spot Forecast page.
- If there is a question on about the forecast from the forecaster, the Spot will be purple. Click on the spot and look at the question from the forecaster.
- If you have feedback on the forecast, at the bottom of the completed forecast is a space to type in feedback, then push the button <Send Feedback>.

Instructions for completing a Spot Forecast request via the Internet - NWS:

- When a request for a Spot Forecast is submitted, an alarm will be posted to AWIPS.
- Go to the Spot Forecast page, and click on the latest Spot Forecast request.
- Near the bottom of the page, click on Initialize forecast.
- Click initialize
- Click on edit forecast
- Edit the forecast and save edits
- Near the bottom, click on send forecast
- The question is posted, do you want to send the forecast?, click send forecast.
- After about 5 minutes, the product FWSXXX will automatically get into AWIPS.

Instructions for completing a Spot Forecast request via the Phone - NWS:

- After receiving the Spot request on the phone, go to the respective office fire page (either through the office intranet or the internet home page), and click on Submit a New Spot Forecast Request
- Click on submit a new request
- Enter data into the request form (red means mandatory entry)
- Click submit request at the bottom of the form
- When the request is submitted, an alarm will be posted to AWIPS
- Go to the Spot Forecast page, and click on the latest Spot Forecast request.
- Near the bottom of the page, click on Initialize forecast.
- On the next page, Click initialize
- Click on edit forecast
- Edit the forecast and save edits
- Near the bottom click on send forecast
- The question is posted, “do you want to send the forecast?” Click send forecast
- After about 5 to 10 minutes the product FWSXXX will be sent from the webpage server into AWIPS. If your system doesn’t already print out the system automatically, then print out the forecast and Fax or call the requesting agency with the forecast

Appendix B - Examples of Fire Weather Products

Fire Weather Planning Forecast (morning) – ARBFWFxxx (The afternoon format is similar)-

```
FNUS5i KNNN DDHHMM
FWFNNN
FIRE WEATHER PLANNING FORECAST
NATIONAL WEATHER SERVICE CITY STATE
TIME-DATE

...HEADLINE...

.DISCUSSION...

SSZXXX-XXX>XXX-DDHHMM-
GEOGRAPHICAL DESCRIPTORS
TIME-DATE

...RED FLAG WARNING/FIRE WEATHER WATCH HEADLINE...

.TODAY...
SKY/WEATHER.........
MAX TEMPERATURE.....
24 HR TREND.......
MIN HUMIDITY........
24 HR TREND.......
WIND.(20 FT/10-MIN AVG)...
HAINES INDEX...
MIXING HEIGHT...
TRANSPORT WINDS.(MPH)...
VENTILATION INDEX...

.TONIGHT...
SKY/WEATHER.........
MIN TEMPERATURE.....
24 HR TREND.......
MAX HUMIDITY........
24 HR TREND.......
WIND.(20 FT/10-min avg)...
HAINES INDEX...
MIXING HEIGHT...
TRANSPORT WINDS.(MPH)...
VENTILATION INDEX...

.TOMORROW...
SKY/WEATHER.........
MAX TEMPERATURE.....
MIN HUMIDITY........
WIND.( 20 FT/10-min avg)....
HAINES INDEX...
MIXING HEIGHT...
TRANSPORT WINDS.(MPH)...
VENTILATION INDEX...

$$
.FORECAST FOR DAYS 3 THROUGH 7...
.DAY3...
.DAY4...
.DAY5...
.DAY6...
.DAY7...
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Fire Weather Watch/Red Flag Warning (RFW).

Single Segment Fire Weather Watch (Red Flag Warning is similar except headline in the body of the product would say “RED FLAG WARNING IN EFFECT” and there would be different coding at the top.)

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WWUS83 Kxxx 012130
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RFWxxx
URGENT - FIRE WEATHER MESSAGE
NATIONAL WEATHER SERVICE Office MI
330 PM EDT WED MAY 1 2011

MIZXXX-XXX-021800-
/O.NEW.KXXX.FW.A.0005.110502T1800Z-110503T0200Z/
COUNTY1-COUNTY2-COUNTY3-COUNTY4-COUNTY5
330 PM EDT WED MAY 1 2011

...FIRE WEATHER WATCH IN EFFECT THURSDAY AFTERNOON AND THURSDAY EVENING...

THE NATIONAL WEATHER SERVICE IN XXXXXX HAS ISSUED A FIRE WEATHER WATCH…WHICH IS IN
EFFECT FOR THURSDAY AFTERNOON AND EVENING.

* WINDS…SOUTHWEST WINDS 10 TO 20 MPH WITH FREQUENT GUSTS TO 30 MPH THURSDAY AFTERNOON
AND EVENING.

* RELATIVE HUMIDITY…HUMIDITIES WILL BOTTOM OUT IN THE 15 TO 20 PERCENT RANGE LATE
THURSDAY AFTERNOON. HUMIDITIES WILL RECOVER QUICKLY AFTER 9 PM.

* TEMPERATURES…TEMPERATURES WILL WARM INTO THE 83-88 DEGREE RANGE BY LATE AFTERNOON ON
THURSDAY.

* IMPACTS…BURN RESTRICTIONS ARE IN EFFECT. FOR MORE INFORMATION ON BURN
RESTRICTIONS…VISIT THE MICHIGAN DNR WEBSITE AT WWW.MICHIGAN.GOV/BURNPERMIT OR CALL 866-
922-2876.

PRECAUTIONARY/PREPAREDNESS ACTIONS…

A FIRE WEATHER WATCH MEANS THAT CRITICAL FIRE WEATHER CONDITIONS ARE FORECAST TO OCCUR.
LISTEN FOR LATER FORECASTS AND POSSIBLE RED FLAG WARNINGS.

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Multiple Segment Fire Weather Watch (Red Flag Warning is similar except headline in the body of the product would say “RED FLAG WARNING IN EFFECT” and there would be different coding at the top.)

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WWUS83 Kxxx 012130
RFWxxx
URGENT - FIRE WEATHER MESSAGE
NATIONAL WEATHER SERVICE Office MI
330 PM EDT WED MAY 1 2011

MIZXXX-XXX-021800-
/O.NEW.KXXX.FW.A.0005.110502T1800Z-110503T0200Z/
COUNTY1-COUNTY2-COUNTY3-COUNTY4-COUNTY5
330 PM EDT WED MAY 1 2011

...FIRE WEATHER WATCH IN EFFECT THROUGH THURSDAY AFTERNOON...

THE NATIONAL WEATHER SERVICE IN XXXXXX HAS ISSUED A FIRE WEATHER WATCH…WHICH IS IN
EFFECT FOR THURSDAY AFTERNOON AND EVENING.

* WINDS…SOUTHWEST WINDS 10 TO 20 MPH WITH FREQUENT GUSTS TO 30 MPH THURSDAY AFTERNOON
AND EVENING.

* RELATIVE HUMIDITY…HUMIDITIES WILL BOTTOM OUT IN THE 15 TO 20 PERCENT RANGE LATE
THURSDAY AFTERNOON. HUMIDITIES WILL RECOVER QUICKLY AFTER 9 PM.

* TEMPERATURES…TEMPERATURES WILL WARM INTO THE 83-88 DEGREE RANGE BY LATE AFTERNOON ON
THURSDAY.

* IMPACTS…BURN RESTRICTIONS ARE IN EFFECT. FOR MORE INFORMATION ON BURN
RESTRICTIONS…VISIT THE MICHIGAN DNR WEBSITE AT WWW.MICHIGAN.GOV/BURNPERMIT OR CALL 866-
922-2876.
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PRECAUTIONARY/PREPAREDNESS ACTIONS…

A FIRE WEATHER WATCH MEANS THAT CRITICAL FIRE WEATHER CONDITIONS ARE FORECAST TO OCCUR.
LISTEN FOR LATER FORECASTS AND POSSIBLE RED FLAG WARNINGS.

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MIZXXX-XXX-021800-
/O.NEW.KXXX.FW.A.0005.110502T1800Z-110503T0200Z/
COUNTY6-COUNTY7-COUNTY8-COUNTY9-COUNTY10
330 PM EDT WED MAY 1 2011

...FIRE WEATHER WATCH IN EFFECT THURSDAY AFTERNOON AND THURSDAY EVENING...

THE NATIONAL WEATHER SERVICE IN XXXXXX HAS ISSUED A FIRE WEATHER WATCH…WHICH IS IN
EFFECT FOR THURSDAY AFTERNOON AND EVENING.

* WINDS…SOUTHWEST WINDS 10 TO 20 MPH WITH FREQUENT GUSTS TO 30 MPH THURSDAY AFTERNOON
AND EVENING.

* RELATIVE HUMIDITY…HUMIDITIES WILL BOTTOM OUT IN THE 15 TO 20 PERCENT RANGE LATE
THURSDAY AFTERNOON. HUMIDITIES WILL RECOVER QUICKLY AFTER 9 PM.

* TEMPERATURES…TEMPERATURES WILL WARM INTO THE 83-88 DEGREE RANGE BY LATE AFTERNOON ON
THURSDAY.

* IMPACTS…BURN RESTRICTIONS ARE IN EFFECT. FOR MORE INFORMATION ON BURN
RESTRICTIONS…VISIT THE MICHIGAN DNR WEBSITE AT WWW.MICHIGAN.GOV/BURNPERMIT OR CALL 866-
922-2876.

PRECAUTIONARY/PREPAREDNESS ACTIONS…

A FIRE WEATHER WATCH MEANS THAT CRITICAL FIRE WEATHER CONDITIONS ARE FORECAST TO OCCUR.
LISTEN FOR LATER FORECASTS AND POSSIBLE RED FLAG WARNINGS.

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Single Segment Red Flag Warning with Overview Section (Fire Weather Watch is similar except headline in the body of the product would say “FIRE WEATHER WATCH IN EFFECT” and there would be different coding at the top.)

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WWUS83 Kxxx 012130
RFWxxx
URGENT - FIRE WEATHER MESSAGE
NATIONAL WEATHER SERVICE Office MI
1030 AM EDT THU MAY 2 2011

...RED FLAG WARNING IN EFFECT THURSDAY AFTERNOON AND THURSDAY EVENING...

.AN AREA OF LOW PRESSURE WILL APPROACH THE AREA TODAY. VERY WARM AIR IS EXPECTED TO MOVE
IN AHEAD OF THIS FRONT AS SOUTHERLY WINDS WILL BECOME GUSTY. THE LACK OF RECENT RAINFALL
ACROSS THE AREA WILL ALLOW FOR VERY DRY CONDITIONS TO CONTINUE INTO THIS EVENING.
CONDITIONS WILL IMPROVE LATE THIS EVENING AND OVERNIGHT TONIGHT AS SHOWERS AND
THUNDERSTORMS ARE EXPECTED TO MOVE IN WITH THE FRONT AT THAT TIME.

MIZXXX-XXX-030200-
/O.NEW.KXXX.FW.W.0005.110502T1800Z-110503T0200Z/
COUNTY1-COUNTY2-COUNTY3-COUNTY4-COUNTY5
1030 AM EDT THU MAY 2 2011
```

...RED FLAG WARNING IN EFFECT THURSDAY AFTERNOON AND THURSDAY EVENING...

THE NATIONAL WEATHER SERVICE IN XXXXXX HAS ISSUED A RED FLAG WARNING…WHICH IS IN EFFECT FOR THURSDAY AFTERNOON AND EVENING.

* WINDS…SOUTHWEST WINDS 10 TO 20 MPH WITH FREQUENT GUSTS TO 30 MPH THURSDAY AFTERNOON AND EVENING.

* RELATIVE HUMIDITY…HUMIDITIES WILL BOTTOM OUT IN THE 15 TO 20 PERCENT RANGE LATE THURSDAY AFTERNOON. HUMIDITIES WILL RECOVER QUICKLY AFTER 9 PM.

* TEMPERATURES…TEMPERATURES WILL WARM INTO THE 83-88 DEGREE RANGE BY LATE AFTERNOON ON THURSDAY.

* IMPACTS…BURN RESTRICTIONS ARE IN EFFECT. FOR MORE INFORMATION ON BURN RESTRICTIONS…VISIT THE MICHIGAN DNR WEBSITE AT WWW.MICHIGAN.GOV/BURNPERMIT OR CALL 866-922-2876.

PRECAUTIONARY/PREPAREDNESS ACTIONS…

A FIRE WEATHER WATCH MEANS THAT CRITICAL FIRE WEATHER CONDITIONS ARE FORECAST TO OCCUR. LISTEN FOR LATER FORECASTS AND POSSIBLE RED FLAG WARNINGS.

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Point Forecast - ARBFWMxxx:

FCST,202902,950323,13,7,21,85,1,1,NW,10,M,26,9,100,60,2,2,N
FCST,202010,950323,13,7,29,90,1,1,SW,12,M,34,14,90,60,2,2,N

Appendix C - Explanation of Fire Weather indices

Haines Index (Low elevations):

The Haines index is an Atmospheric severity Index used to determine fire severity due to the stability of the lower atmosphere, typically used for days when plume dominated fires are likely. The terms in the index are the lapse rate between 950mb and 850mb (F1) and the moisture availability at 850mb by calculating the dew point depression (F2). Once the lapse rate and dew point depressions have been calculated, look up the appropriate value for each term (A and B) and add the numbers together (A+B). The lowest the index will be is 2 and the highest is 6.

Haines Index = A + B

F1 = T950 - T850

F1 = 3 deg C or less then	A = 1
F1 = 4-7 C then	A = 2
F1 = 8 deg C or more then	A = 3

F2 = T850 - Td850

F2 = 3 deg C or less then	B = 1
F2 = 4-7 C then	B = 2
F2 = 8 deg C or more then	B = 3

Ventilation Index:

This index is found by multiplying the mixing height (feet) with the transport wind speed (mph), then dividing by 100.

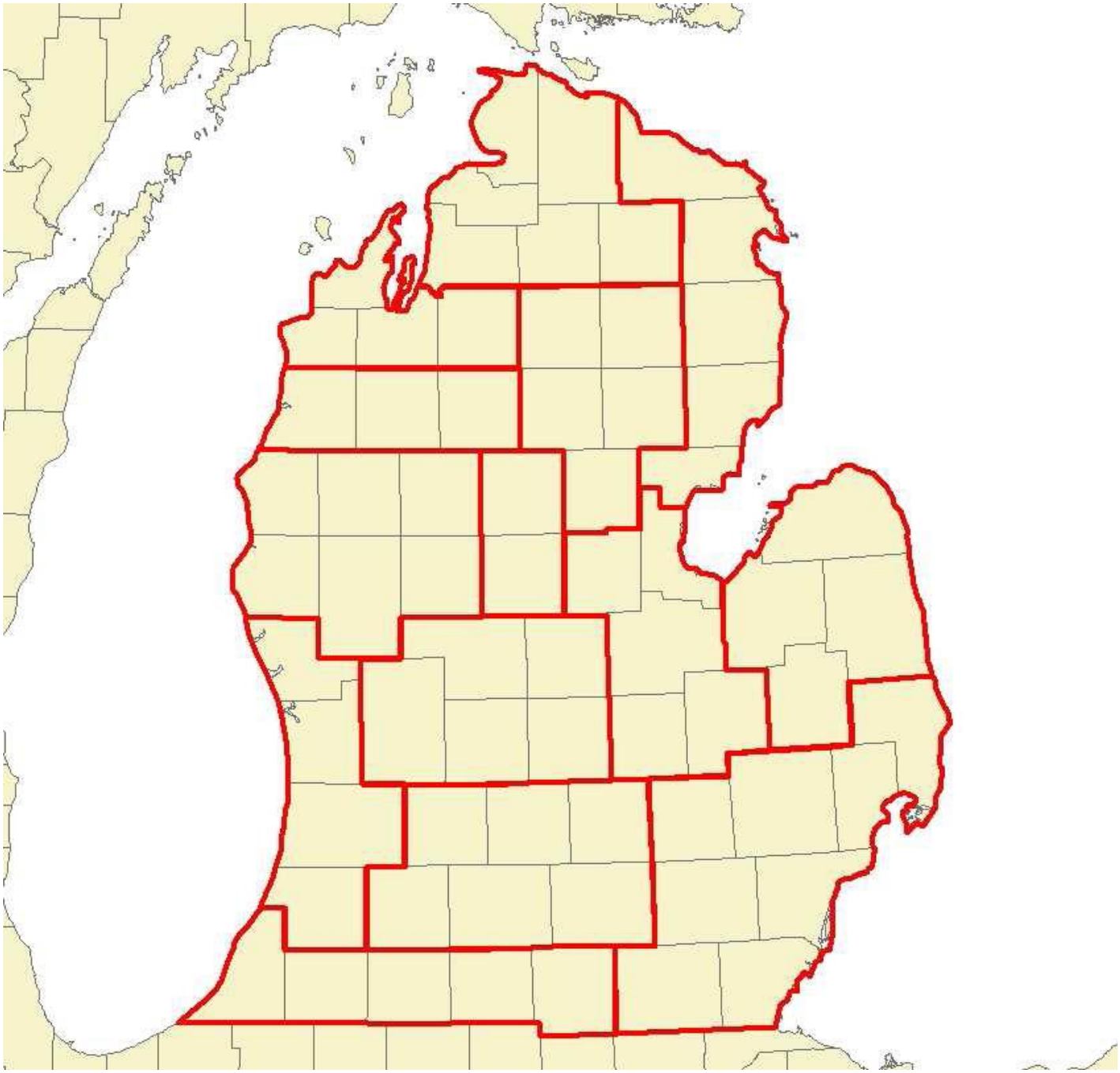
Example...
Mixing height = 14,000 feet
Transport wind = 15 mph
VI = 14,000 * 15 / 100 = 2100(no units)

Example...
Mixing height = 5,000 feet
Transport wind = 10 mph
VI = 5,000 * 10 / 100 = 500 (no units)

VI scale...
Less than 130 = POOR dispersal
130 – 299 = FAIR dispersal
300 – 599 = GOOD dispersal
600 and greater = EXCELLENT dispersal

A ventilation index of zero implies no ability for the atmosphere to disperse smoke or pollutants, while a value of 600 or greater implies an excellent ability to disperse smoke or pollutants. The United States Forest Service and Department of Natural Resources has requested that when the VI is “fair”, that we include a number value along with the term.

Appendix D - Lower Michigan Fire Zone Groupings



Appendix E - Experimental Smoke Modeling Plumes

National Weather Service
Michigan

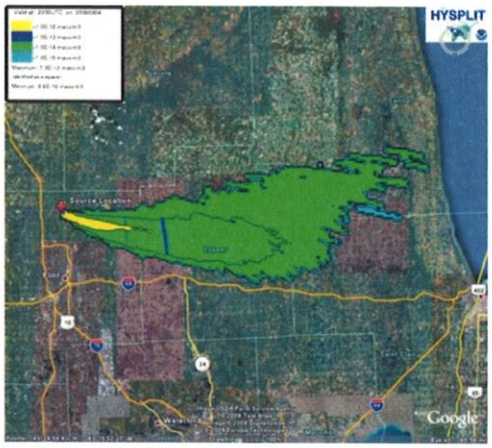
Model Smoke Plumes for Prescribed Burns

HYSPLIT Dispersion Model • HYSPLIT Dispersion Model • HYSPLIT Dispersion Model • HYSPLIT Dispersion Model • HYSPLIT Dispersion

NOAA HYSPLIT Dispersion Model

National Weather Service offices that provide service to Michigan can offer land management agencies a model depiction of smoke plumes generated from prescribed burns of 100 acres or larger.

The forecast plumes are generated from the NOAA Air Resources Laboratory dispersion model, HYSPLIT. This model, normally used to support HazMat incidents, can generate graphical representations of how a smoke or chemical plume will evolve over time and space. A special module for prescribed burns has been developed within HYSPLIT that combines parameters from the U.S. Forest Service's BlueSky model (such as smoke emission and heat release) with a meteorological model selected by an NWS forecaster.



Example Output from NOAA HYSPLIT Dispersion Model

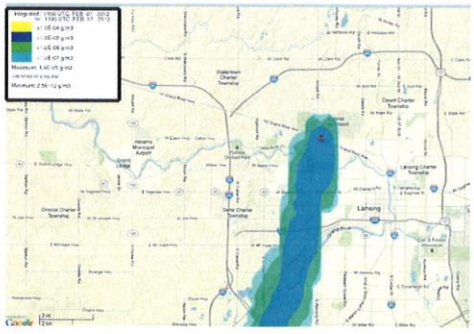
As this forecast is generated purely from a computer model and cannot take into account input from NWS Meteorologists, there are some limitations users should be aware of. It is important to discuss any concerns with an NWS forecaster, as they may be able to provide guidance regarding these limitations. Model forecasts should be considered experimental, and should only be used as an additional resource to aid in decision making.

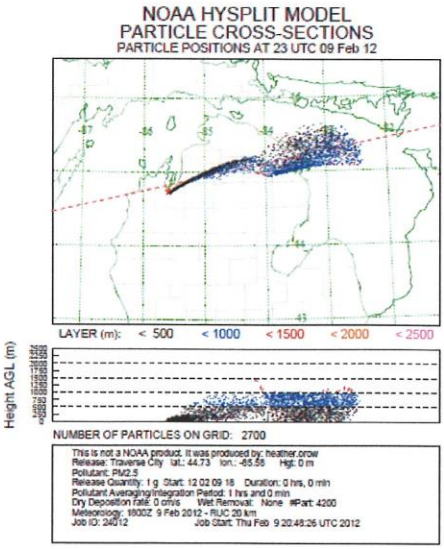
HYSPLIT limitations include:

- Will not handle smoke dispersion in complex terrain well.
- May not catch small-scale weather phenomena, such as lake breezes or outflow boundaries from thunderstorms.
- Will work best with larger burns (more than 100 acres) lasting more than one hour.
- The model surface layer is an average between the surface and 100 meters (330 ft) above ground level.
- Runs via the internet from a NOAA partner website, and may occasionally be unavailable due to internet issues.
- HYSPLIT can only model PM2.5 concentrations.

Dispersion Model Output Graphics

- Can generate images of smoke plume concentrations in 15 min, 30 min, or 1 hour increments.
- HYSPLIT Dispersion Model forecasts must be emailed.
- Data is available in KMZ (Google Earth), animated GIF plots (GIF and Java), Postscript, PDF, and GIS shapefile formats.





HYSPLIT Dispersion Model • HYSPLIT Dispersion Model • HYSPLIT Dispersion Model • HYSPLIT Dispersion

How to request a HYSPLIT Dispersion run:

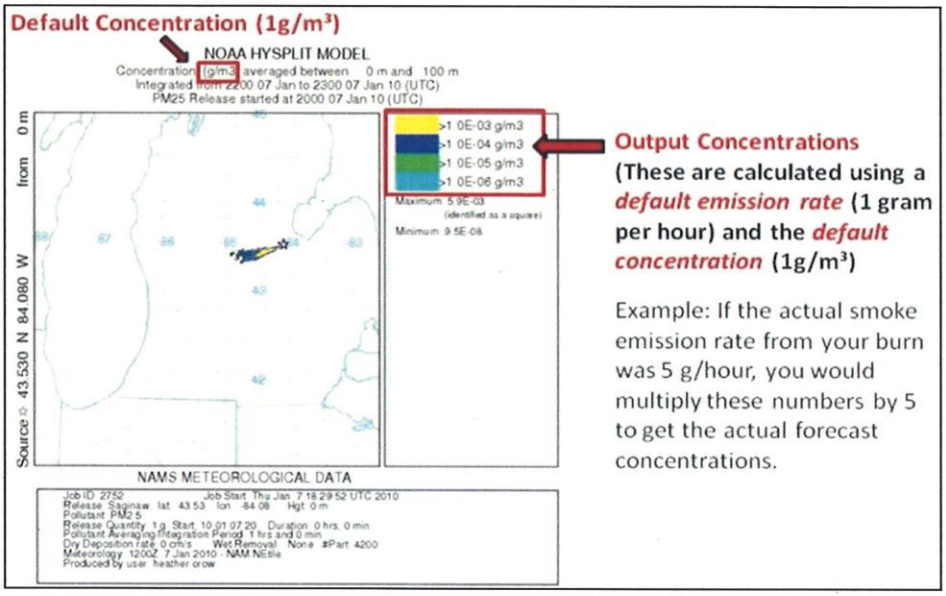
1) Request HYSPLIT output from your local Michigan NWS office by phone.

2) Provide the following information, if not already included in a spot forecast request.
   - A. Latitude and Longitude
   - B. Size of burn (in acres)
   - C. Ignition date and time
   - D. Duration of burn (must be at least one hour)
   - E. Contact phone number
   - F. Email address to send output files
   - G. Preferred format for files (KMZ, animated GIF, PDF, Postscript, GIS)

UNLISTED
Detroit/Pontiac:
(248) 625-4139
(248) 625-4249
Gaylord:
(989) 732-9306
(989) 731-3384
Grand Rapids:
(616) 949-0640
(616) 949-5150
Marquette:
(906) 475-5213
(906) 475-6205
Northern Indiana:
(574) 834-1183
(574) 834-1104 x362

Interpreting the results for output concentrations:

Model output concentrations (the output graphics) are calculated using a default concentration and a default emission rate. These two parameters tell the model how much smoke to release, and how fast to release it. The default concentration rate will always be 1 unit of mass per cubic meter (for example, 1 g/m³). The default emission rate will always be one mass unit per hour (for example, 1g/hour).



Since the output graphics use a default concentration and a default emission rate, the raw HYSPLIT smoke concentrations shown on the output graphics do not represent actual concentrations and cannot be used to estimate health impacts. If the actual emission rate of smoke per hour is known, you can perform a simple calculation to obtain actual concentrations: **Actual concentrations = actual emission rate x output concentrations**

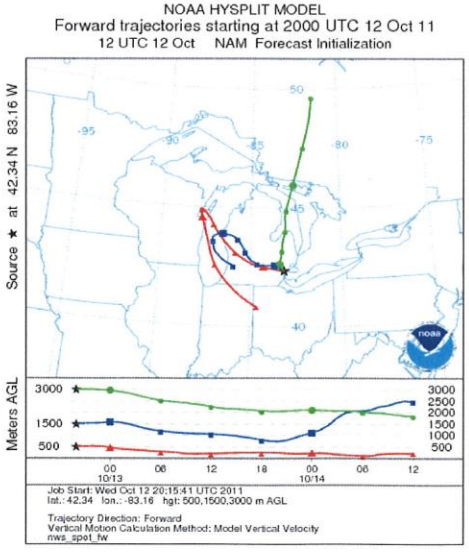
HYSPLIT Trajectory Model • HYSPLIT Trajectory

NOAA HYSPLIT Trajectories Forecast

The HYSPLIT trajectories option provides an easy method for NWS partners to quickly receive smoke forecast information, and takes advantage of information already included in the spot forecast request form. No intervention from an NWS forecast is required. The HYSPLIT Trajectories Request Function gives a model depiction of where an air parcel would travel from a given longitude and latitude, starting at a specific elevation. The model output provides users with HYSPLIT trajectory runs at 500, 1500, and 3000 meters above the ground. Model runs will start at the place and ignition time provided in the spot forecast request.

The image to the right shows a 3 level trajectory forecast (at 500, 1500, and 3000 meters) for a prescribed burn located near Detroit, MI. The panel at the bottom of the map shows the vertical projection of the air parcel with time.

To request HYSPLIT trajectories from NWS Spot Forecast request webpages, just enter the phrase "Hysplit email@domain.gov" into the remarks section of the spot forecast request form. The HYSPLIT trajectory raw data (in a table format), along with .gif and .kml (Google Earth) files will be sent to the specified email address. This functionality is available nationwide.



2016 Signature Page

United States Forest Service
Huron-Manistee National Forest — 3/12/16 Date

Michigan Department of Natural Resources
Regional Headquarters — 3/10/16 Date

National Park Service
Sleeping Bear Dunes National Lakeshore — 3/14/16 Date

United States Fish and Wildlife Service — 3/18/16 Date

CHRISTOPHER WIGGINS Digitally signed by CHRISTOPHER WIGGINS DN: c=US, o=U.S. Government, ou=Department of the Interior, ou=Indian Affairs (Assistant Secretary), cn=CHRISTOPHER WIGGINS, 0.9.2342.19200300.100.1.1=14001000750441 Date: 2016.03.15 11:51:18 -04'00'

Bureau of Indian Affairs — Date

NOAA National Weather Service
Gaylord, MI (APX) — 3/23/16 Date

NOAA National Weather Service
Detroit/Pontiac, MI (DTX) — 3/25/16 Date

NOAA National Weather Service
Grand Rapids, MI (GRR) — 3/9/16 Date

NOAA National Weather Service
North Webster, IN (IWX) — 3/24/16 Date